

Installation Manual

Version 02E65a

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SECTION 1 - INTRODUCTION

General

The Models F500-1, F500-2, and F500-3 Floco Positive Displacement Meters are designed to measure the flow of a broad range of liquids, including viscous, corrosive, and abrasive substances. Like all Floco meters, these models measure the flow by separating it into segments of known volume and then counting the segments. The rotor design allows small solid particles and sediment to pass through without causing damage or malfunction. Bridge seals prevent liquid from passing to the outlet port without being measured.

F500-1 and F500-2 have identical parts, except for housing thread connections. The Model 500 Magnetic Coupling Assembly is used on the register side of the meter. A low pressure seal is used on the sampler side when a sampler is used (see FRA Sampler manual for details). F500-3 parts are identical to the F500-1 and -2, except for the sideplate assemblies.

Floco Positive Displacement Meters are made up of five basic components: body, bridge, rotor, side plates and register. The fluid passing through the meter is divided into segments by the blades of the rotor. Three segments pass through the meter each time the rotor completes a revolution. By counting rotor revolutions, a measure of the fluid is obtained.



SAFETY

Before installing this instrument, become familiar with the installation instructions in Section 2. **WARNING** notes that appear on the following pages of this manual should be reviewed before proceeding: **NONE**.

Liquid entering the meter is deflected downward by the bridge against the rotor blades. The force of the liquid on each successive blade causes the rotor to turn. The liquid between the blades is moved to the outlet port, where it is discharged as the bridge reduces the volume of the flow segment.

The rotor is magnetically coupled to the register drive shaft which is connected to the register by appropriate calibration gears. The design of the rotor allows small particles to pass through the meter without causing damage or malfunction.

Performance Data

The graphs on the next page can be used as a guide in selecting the appropriate Floco meters for a particular application.

Meter Accuracy with Various Component Materials

This graph shows the relative effect on the accuracy of the four most popular combinations of bridge and elastomer materials for a fluid of 100 SSU, and a two-inch Floco Industrial Meter. The pressure drop across the meter was not effected by changing bridge and elastomer material.

An increase in the viscosity would flatten these curves, while a decrease in the viscosity would cause the curves to droop more, but the relative positions would remain the same.

The steel bridge and Buna-N elastomer gave the best accuracy over the full range of the meter.

By selecting the proper calibration gears, it is possible to calibrate the meter for optimum accuracy on the fluid being measured at the normal operating point.

Similar curves on the three-inch Floco Industrial Meter would show the same relative relations.

Accuracy and Pressure Drop

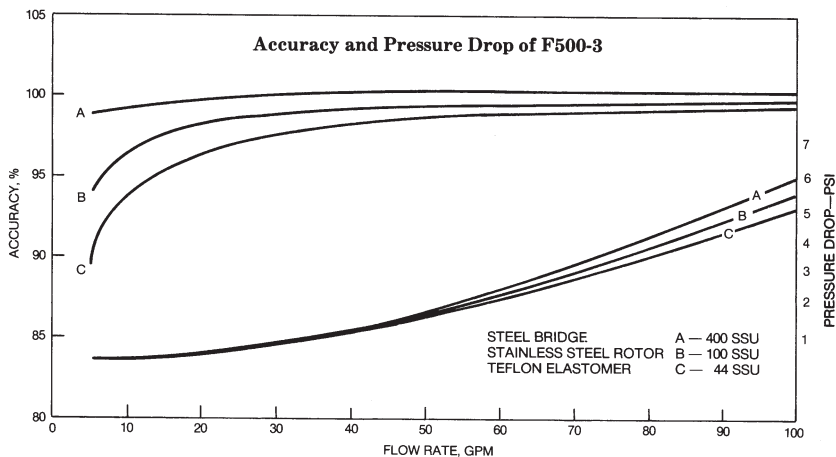
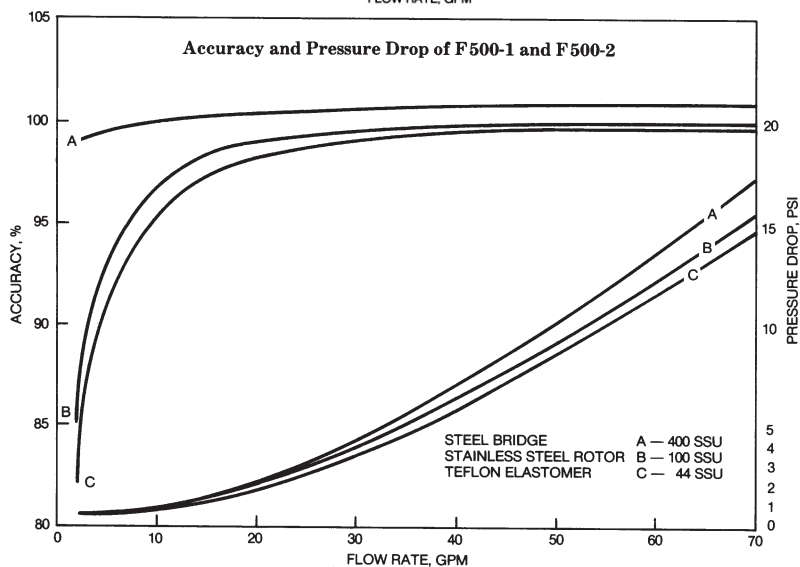
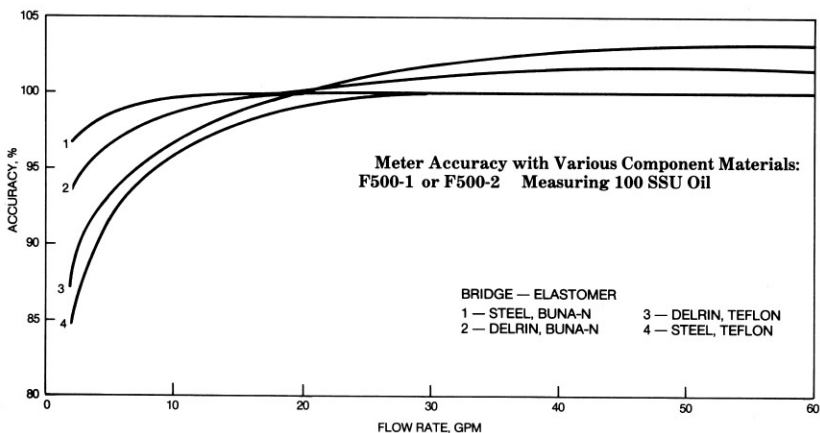
The next two graphs show the relationship of flow rate, pressure drop across the Floco meter, and accuracy for fluids of various viscosities flowing in a meter with a steel bridge, stainless steel rotor, and teflon elastomers. The viscosities used were 44, 100 and 400 SSU.

Water at 68°F has a viscosity of 31 SSU, which would give curves for accuracy and pressure drop very close to those of the 44 SSU viscosity tested.

The steel bridge, stainless steel rotor, with teflon elastomers was selected as it is being used more and more on industrial applications on corrosive fluid. When the fluid is abrasive, the elastomers should be changed to Viton or Buna-N, if fluid compatibility will allow. The customer is actually in the best position to determine the choice of materials compatible with his service. You should advise him of the material available and let his experience help determine the proper choice of material.

A review of the Accuracy and Pressure Drop graphs will show that the pressure drop on the three-inch Floco meter is about 50% of the pressure drop on the one- and two-inch Floco meters. If this parameter is more important than the slight difference in accuracy and cost, then the three-inch size should be recommended.

Measurements have been made which indicate that Floco meters will work well with fluid viscosities at least as high as 10,000 SSU.



SECTION 2 - INSTALLATION

Unpacking

Check the shipment for damage and, if any is noted, file a claim with the transportation company and notify the nearest Barton Sales Office as soon as possible.

Precautions

The following precautions must be observed to assure safe and effective performance of Floco meters:

Lines: The flow lines upstream of the Floco meter should be purged to remove scale, rocks, welding slag or other debris prior to installing the meter, if no bypass manifold is used.

Control Valves: Control valves should be opened slowly to permit charging of the Floco meter with liquid before normal operation begins. Sudden surges of pressure or gas can severely damage the Floco meter assembly if the valves are not opened slowly.

Liquids with Gas or Vapor: If the liquid to be measured contains gas or vapor, a separator or air eliminator must be used ahead of the Floco meter to prevent rotor damage.

Mounting

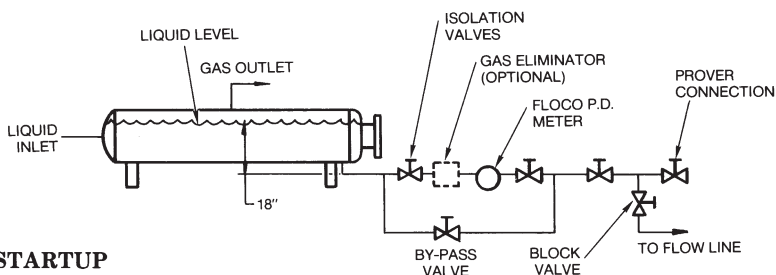
The meter may be mounted either horizontally or vertically. When mounting horizontally, orient the nameplate upward. When mounting vertically, the liquid flow should be downward.

Typical Installations (pages 5-8)

Separators (page 5)

1. The meter may be mounted on any liquid/gas separator that has been or may be adapted to liquid level controllers.
2. Liquid level height should be maintained at least 18 inches above liquid outlet.
3. The liquid level control valve should always be downstream from meter.
4. Isolation valves and a bypass manifold should be included in the mounting assembly to permit normal operation if meter repairs are necessary.

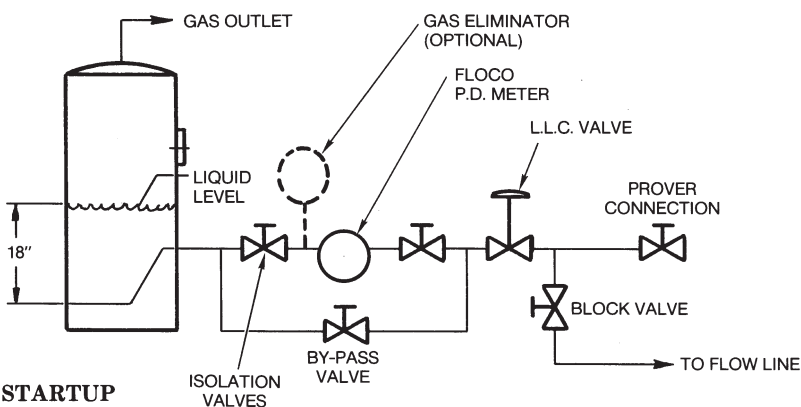
Horizontal Separator, Liquid Flow



STARTUP

1. Open bypass valve and block valve. Close isolation valves and prover connection.
2. Allow sufficient flow through bypass loop to purge vessel and piping of gas and debris.
3. Set liquid level control valve to maintain a maximum height practicable above oil outlet.
4. Slowly open upstream isolation valve to equalize pressure and charge the Floco P.D. Meter.
5. Slowly open downstream isolation valve to permit meter to operate.
6. Close bypass valve.

Vertical Separator, Liquid Flow

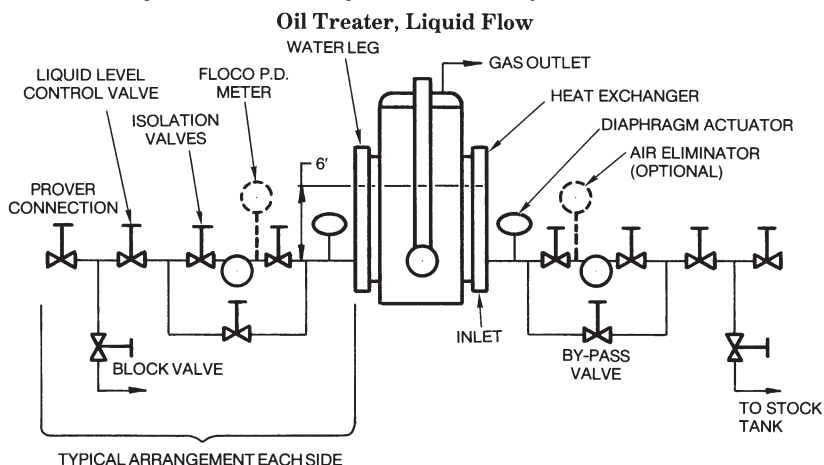


STARTUP

1. Open bypass valve and block valve. Close isolation valves and prover connection.
2. Allow sufficient flow through bypass loop to purge vessel and flow lines of gas and debris.
3. Set liquid level control valve to maintain a minimum level of 18 inches above oil outlet.
4. Slowly open upstream isolation valve to equalize pressure and charge the Floco P.D. Meter.
5. Slowly open downstream isolation valve to permit meter to operate.
6. Close bypass valve.

Oil Treaters

1. The Floco meter may be mounted on both oil and water outlets. The downcomer in either case should be at least two times flow line pipe diameter, and never less than 4 inches O.D..
2. The liquid level in each downcomer should be adjusted so that minimum liquid height after dump is six feet.
3. Liquid level control valves should always be downstream from the meter.
4. Throttling controls should not be used.
5. The meter manifold should include a bypass with isolation valves to permit normal operation if meter repairs are necessary.



STARTUP

1. Close all valves until liquid level has been established in treater.
2. Open both block valves and bypass valves.
3. Allow sufficient flow to purge lines of gas and debris.
4. Set liquid level controls on each side to maintain a minimum height of 6 feet above liquid outlet.

NOTICE

WATER LEG AND OIL LEG SHOULD BE APPROXIMATELY TWO PIPE DIAMETERS, OR 4 INCHES OD MINIMUM.

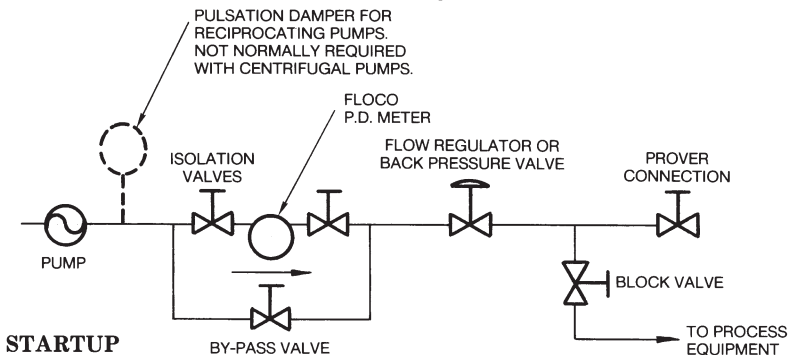
5. Open upstream isolation valves slowly to permit pressure to equalize and to charge Floco P.D. Meter.
6. Open downstream valves to permit meter to operate.
7. Close bypass valves.

Flow Line (page 7)

1. The meter may be mounted in a flow line, but should have a control valve or back pressure valve downstream from the meter.
2. The meter manifold should include a bypass manifold with isolation valves to permit normal operation if meter repairs are necessary.

- Where gas or air is present in the flow line, a gas eliminator should be installed ahead of the meter.

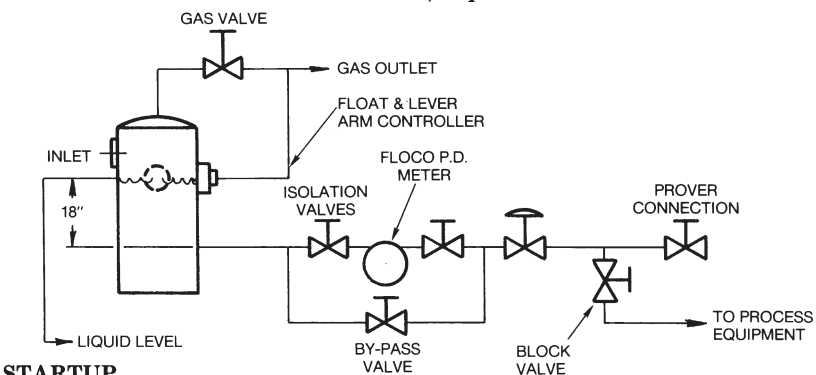
Flow Line, Liquid Flow



STARTUP

- Open bypass valve and block valve. Close isolation valves and prover connection.
- Start pump and set back pressure valve to control flow rate or back pressure.
- Allow sufficient flow through bypass loop to purge flow lines of gas and debris.
- Open upstream isolation valve slowly to equalize pressure and charge the Floco P.D. Meter.
- Open downstream valve slowly to permit meter to operate.
- Close bypass valve.

Gas Eliminator, Liquid Flow

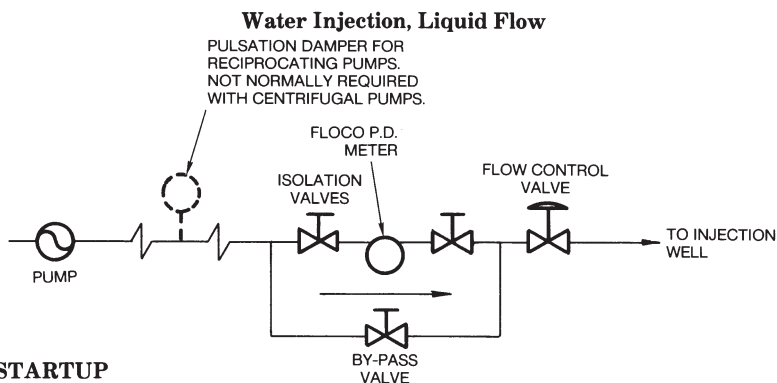


STARTUP

- Close prover connection and isolation valves. Open bypass valve and block valve.
- Allow sufficient flow through bypass loop to purge the vessel and piping of excessive gas and debris.
- Adjust lever arm float controller to open gas valve when liquid level falls below 18 inches above oil outlet. Set back pressure valve to correct back pressure.
- Open upstream isolation valve slowly to equalize pressure and charge the Floco P.D. Meter.
- Open downstream isolation valve slowly to permit meter to operate.
- Close bypass valve.

Waterflood Injection

1. The meter may be mounted either near the injection well or in a meter manifold near the injection pump.
2. The meter manifold should include a bypass manifold with isolation valves to permit normal operation if meter repairs are necessary.
3. The flow rate control valve should always be installed downstream from the meter.
4. If pulsation or vibration is possible, a pulsation dampener should be installed ahead of the meter. Severe pulsation can cause rotor damage.



STARTUP

1. Close isolation valves. Open bypass valve and flow control valve.
2. Start pump and allow sufficient flow through bypass loop to purge flow line of air, gas and debris.
3. Open upstream isolation valve slowly to equalize pressure and charge Floco P.D. Meter.
4. Open downstream isolation valve slowly to permit Floco meter to operate.
5. Close bypass valve.
6. Set proper flow rate by adjusting flow control valve.

SECTION 3 - OPERATION/CALIBRATION

Startup Procedures (General)

Specific application procedures are on pages 4-8.

1. Start with isolation valves closed.
2. Permit flow through the bypass for a time sufficient to purge the flow lines of gas and other undesirables. During the startup phase, adjust the liquid level controls (where applicable).
3. Open the isolation valve ahead of the meter slowly to equalize the pressure across the meter.
4. Open the downstream isolation valve or control valve slowly to allow the meter to start operating.
5. Close the bypass valve.
6. Adjust downstream control valve to obtain proper flow rate through meter.

NOTICE: The Floco meter does not normally require an upstream strainer. However, in applications where large solid fragments may enter the flow lines, a filter may be used without modifying the meter. If the liquid stream contains dissolved gas or vapors, a gas eliminator should be installed ahead of the meter.

Proving

The Floco Positive Displacement Meter may be calibrated by three proving methods: Gravimetric Proving, Volumetric Proving, or Master Meter Proving. Meter proving by any method is basically a laboratory operation and should be performed carefully to obtain accurate data and exact mathematical calculations. (*Refer to American Petroleum Institute API Standard 1101, August 1960.*)

A. Gravimetric Proving

A method used when the metered liquid contains entrained gas or vapor, paraffin, wax, sand or other solids, or is heavy or viscous.

This method requires careful weighing of the quantity of liquid that passes through the meter. The net weight of the metered liquid is converted to volume (corrected for temperature and pressure where necessary). The metered volume is compared to the computed volume and the correct meter factor is obtained.

B. Volumetric Proving

A method that requires fewer calculations than Gravimetric Proving; therefore, requires less time to perform. However, errors may result if the liquid is viscous or contains entrained gas or vapor, solids, paraffins, or other impurities which may adhere to the calibrating vessel.

This method requires the use of a vessel calibrated for a known volume. The calibration vessel must be cleaned thoroughly before and after each use. The metered volume through the meter is compared to the true volume of the calibrated vessel to obtain the correct meter factor.

C. Master Meter Proving

A method that requires installing a meter of known accuracy into a prover loop. The readings of the production meter (meter being calibrated) are compared after the test with the readings of the master meter.

Calibration

After the meter is proved and the true volume and meter volume are obtained, the meter may be calibrated by changing two nonslip, positive-drive change gears, located between the register assembly and the gear case assembly. *These gears may be changed while the meter is in operation.*

Selection

Selection of the correct change gears is done by dividing the true volume into the metered volume:

$$\begin{aligned} \text{True Volume: } &100 \text{ barrels (gallons, liters, etc.)} \\ \text{Metered Volume: } &104 \text{ barrels (gallons, liters, etc.)} \\ &104/100 \times 100 = 104\% \text{ (now being registered)} \end{aligned}$$

The tables that follow indicate gear changes required to calibrate meters to approximately 100% accuracy when percent registered is known.

Example: The Floco meter registers 104 barrels. True volume is 100 barrels. Using formula above, % registered is calculated to be 104%. For a one- or two-inch meter, the 0.670-30 driven gear and the 0.670-26 drive gear will return the meter to approximately 100% accuracy. For a three-inch meter, gears would change to 0.460-22 and 0.860-38. These charts are correct only if % registered is calculated from meters with standard gears, as underlined in the two charts.

Accuracy

It must be noted that all positive displacement meters require a meter factor number for extreme accuracy. The meter factor number may be determined by dividing the true (calculated) volume by the metered volume:

$$\text{True Volume} / \text{Metered Volume} = \text{Meter Factor}$$

The metered volume for future accounting is then multiplied by the meter factor to obtain the true volume: *True Volume x Meter Factor = True Volume*

Calibration Chart — 42 Gallon U.S. Barrels

| Percent Registered | 1" or 2" Meters | | | | 3" Meters | | | |
|--------------------|-----------------|------|-------|------|-----------|------|-------|------|
| | Driven | | Drive | | Driven | | Drive | |
| | Teeth | Dia. | Teeth | Dia. | Teeth | Dia. | Teeth | Dia. |
| 105 | 28 | .670 | 24 | .670 | 21 | .460 | 36 | .860 |
| 104 | 30 | .670 | 26 | .670 | 22 | .460 | 38 | .860 |
| 103 | 32 | .670 | 28 | .670 | 20 | .460 | 35 | .860 |
| 102 | 34 | .670 | 30 | .670 | 21 | .460 | 37 | .860 |
| 101 | 28 | .670 | 25 | .670 | 23 | .460 | 41 | .860 |
| 100 | 30 | .670 | 27 | .670 | 20 | .460 | 36 | .860 |
| 99 | 33 | .670 | 30 | .670 | 22 | .460 | 40 | .860 |
| 98 | 35 | .670 | 32 | .670 | 19 | .460 | 35 | .860 |
| 97 | 28 | .670 | 26 | .670 | 20 | .460 | 37 | .860 |

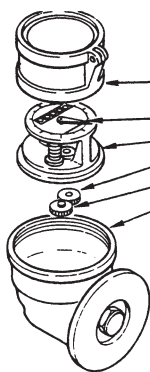
Calibration Chart — U.S. Gallons

| Percent Registered | 1" or 2" Meters | | | | 3" Meters* | | | |
|--------------------|-----------------|------|-------|------|------------|------|-------|------|
| | Driven | | Drive | | Driven | | Drive | |
| | Teeth | Dia. | Teeth | Dia. | Teeth | Dia. | Teeth | Dia. |
| 105 | 21 | .460 | 38 | .860 | 32 | .770 | 23 | .570 |
| 104 | 23 | .460 | 42 | .860 | 33 | .770 | 24 | .570 |
| 103 | 20 | .460 | 37 | .860 | 34 | .770 | 25 | .570 |
| 102 | 23 | .460 | 43 | .860 | 35 | .770 | 26 | .570 |
| 101 | 18 | .460 | 34 | .860 | 32 | .770 | 24 | .570 |
| 100 | 20 | .460 | 38 | .860 | 33 | .770 | 25 | .570 |
| 99 | 23 | .460 | 44 | .860 | 30 | .770 | 23 | .570 |
| 98 | 18 | .460 | 35 | .860 | 31 | .770 | 24 | .570 |
| 97 | 22 | .460 | 43 | .860 | 32 | .770 | 25 | .570 |

*10 Gallon Readout on 3" Meter.

One Gallon Readout on 3" Meter:
Drive .958 Dia. Teeth: 45 Gear Ratio: 12½ to 1
Driven .375 Dia. Teeth: 19 Worm: P/N 0000.3192.0
Worm Gear: P/N 0000.3193.0

COMPLETE
REGISTER
ASSEMBLY



A332 REGISTER BOX
(Standard for all Meters)

SWEEP HAND

REGISTER

DRIVEN GEAR











DRIVE GEAR

GEAR CASE (ADAPTER)

CHANGE GEARS
(Order by number of teeth and diameter)

Calibration Gear Chart

All Listings on this Sheet are Standard Issue

| | |  |  | CHANGE GEAR (TOP)  | | CHANGE GEAR (BOTTOM)  | | MAGNETIC DRIVE GEAR RATIO | MODEL MC-500 MAGNETIC COUPLING ASSEMBLY | |
|--------------|---|---|---|--|------------|---|---------|---------------------------|---|------------|
| | | REGISTER PART NO. | NO. TEETH | DIA. | NO. TEETH | DIA. | KIT NO. | | PART NO. | |
| 42 GAL. BBL. |  | F500-1, F500-2 | 3059 | 30 | .670 | 27 | .670 | 40:1 | 1 | 0500-0009A |
| | | F500-3 | 3059 | 20 | .460 | 36 | .860 | 40:1 | 1 | 0500-0009A |
| | | F2500-1, F2500-2 | 3059 | 30 | .670 | 27 | .670 | 40:1 | 1 | 0500-0009A |
| | | F5000-1 | | 4 | 0500-0021A | | | | | |
| | | F2500-3 | 3059 | 20 | .460 | 36 | .860 | 40:1 | 1 | 0500-0009A |
| U.S. GALS. |  | F500-1, F500-2 | 3015 | 20 | .460 | 38 | .860 | 20:1 | 2 | 0500-0007A |
| | | F500-3 | 3015 | 19 | .375 | 45 | .958 | 12:5 to 1 | 3 | 0500-0006A |
| | | F2500-1, F2500-2 | 3015 | 20 | .460 | 38 | .860 | 20:1 | 2 | 0500-0007A |
| | | F5000-1 | | 5 | 0500-0019A | | | | | |
| | | F5000-1 | 3015 | 19 | .375 | 45 | .958 | 12:5 to 1 | 3 | 0500-0006A |
| IMP. BBL. |  | F500-1, F500-2 | 3131 | 30 | .670 | 27 | .670 | 40:1 | 1 | 0500-0009A |
| | | F500-3 | 3131 | 20 | .460 | 36 | .860 | 40:1 | 1 | 0500-0009A |
| | | F2500-1, F2500-2 | 3131 | 30 | .670 | 27 | .670 | 40:1 | 1 | 0500-0009A |
| | | F5000-1 | | 4 | 0500-0021A | | | | | |
| | | F2500-3 | 3131 | 20 | .460 | 36 | .860 | 40:1 | 1 | 0500-0009A |
| IMP. GALS. |  | F500-1, F500-2 | 3127 | 23 | .570 | 36 | .770 | 20:1 | 2 | 0500-0007A |
| | | F500-3 | 3127 | 21 | .460 | 41 | .860 | 12:5 to 1 | 3 | 0500-0006A |
| | | F2500-1, F2500-2 | 3127 | 23 | .570 | 36 | .770 | 20:1 | 2 | 0500-0007A |
| | | F5000-1 | | 5 | 0500-0019A | | | | | |
| | | F2500-3 | 3127 | 21 | .460 | 41 | .860 | 12:5 to 1 | 3 | 0500-0006A |
| CUBIC METERS |  | F500-1, F500-2 | 3132 | 23 | .570 | 33 | .770 | 40:1 | 1 | 0500-0009A |
| | | F500-3 | 3132 | 23 | .570 | 33 | .770 | 20:1 | 2 | 0500-0007A |
| | | F2500-1, F2500-2 | 3132 | 23 | .570 | 33 | .770 | 40:1 | 1 | 0500-0009A |
| | | F5000-1 | | 4 | 0500-0021A | | | | | |
| | | F2500-3 | 3132 | 23 | .570 | 33 | .770 | 20:1 | 2 | 0500-0007A |
| LITERS |  | F500-1, F500-2 | 3129 | 23 | .570 | 33 | .770 | 40:1 | 1 | 0500-0009A |
| | | F500-3 | 3129 | 23 | .570 | 33 | .770 | 20:1 | 2 | 0500-0007A |
| | | F2500-1, F2500-2 | 3129 | 23 | .570 | 33 | .770 | 40:1 | 1 | 0500-0009A |
| | | F5000-1 | | 4 | 0500-0021A | | | | | |
| | | F2500-3 | 3129 | 23 | .570 | 33 | .770 | 20:1 | 2 | 0500-0007A |

SECTION 4 - MAINTENANCE AND REPAIR

Maintenance

Regular inspection and preventive maintenance of Floco meters will ensure a long and trouble-free service life. The following procedure is suggested as a maintenance program. However, this program should be adapted to the type of liquid metered, based on corrosive and abrasive qualities.

1. Inspect the register assembly semi-annually: All gears shall turn freely and assembly shall be free of scale and corrosion.
2. Lubricate magnetic coupling and gears with one ounce of light oil.
3. If the meter accuracy changes, inspect the rotor assembly. Inspect specifically the edges of the hinges and the rotor hub (where a positive seal is required) for separation or splitting of the elastomer. Replace the rotor blades or rotor body if splitting or separation of the elastomer is apparent or if portions of the elastomer are missing.
4. Inspect bearings every 25,000 barrels (4,000 cubic meters) for excessive wear. Tests on brine indicate satisfactory service even after metering 100,000 barrels (16,000 cubic meters). Replace bearings if rotor shafts become scored, if bearings surface shows excessive wear, or if bearing becomes out of round.
5. Inspect bridge and bridge seals semi-annually or whenever sideplate is removed. Bridge seals should not be split, chipped or elongated.
6. Liners should be inspected annually for excessive wear or scoring. If liner is excessively worn, replace with new liner (refer to para. **A. Body** on next page). If slightly scored, the liner may be polished with a fine emery cloth.
7. Inspect the wearplates whenever the sideplate is removed or whenever the meter accuracy varies. If the wearplates show excessive wear (worn through chrome plating), reverse or replace the plates. Do not confuse a normal wear pattern with excessive wear. The rotor will normally wear a pattern on the wearplate.

Tools Required For Maintenance And Troubleshooting

| Item | Purpose |
|---------------------------------------|---------------------------------|
| 5/16-inch hex key | To remove sideplate bolts. |
| 1-inch open-end wrench | To remove magnetic coupling. |
| 7/32-inch hex key | To remove bridge screws. |
| Long-nose pliers | To remove rotor hinge pin. |
| File | To dress replaced liner. |
| Wide blade screwdriver | To replace bearings. |
| Rotor spring tool No. 0000.22090 | To remove rotor springs. |
| Sideplate bushing tool No. 0000.14340 | To remove and replace bushings. |
| E-018 Truarc applicator | To remove retaining ring. |
| 1/32-inch pin punch | To remove pin in worm. |
| Small ballpeen hammer | To install pin in worm. |

Troubleshooting

NOTE: Visual inspection of the rotor assembly and the magnetic coupling will reveal most causes of malfunctions in the Floco Meters.

| Problem | Possible Sources | Probable Cause | Corrective Action |
|----------------------|----------------------|---|--|
| No Flow Indication | Rotor Hinge | Broken Hinge | Replace Hinge |
| | Rotor Shaft | Broken or Worn Shaft | Replace Rotor Body |
| | | | Inspect Bearing Surfaces (wear of these surfaces may be the cause of shaft failure) |
| | Magnetic Coupling | Slipping Magnetic Coupling | Remove Register and observe worm gear. If it is rotating, check register for excessive drag. Determine the cause and correct. If worm gear is not rotating, trouble is in magnetic coupling. |
| Low Flow Indication | Bypass Valve | Valve Leak | Repair or Replace Valve |
| | Wearplates | Plate Worn | Reverse or Replace Wearplates |
| | Calibration Gears | Worn or Incorrect Gears | Replace Gears |
| | Bridge Seals | Worn Seals | Replace Bridge Seals |
| | Rotor Hinge | Worn or Broken Hinges | Replace Hinges |
| | | Slow Closing Rotor Hinges due to large change in viscosity of service fluid | Recalibrate Meter Using Service Fluid |
| High Flow Indication | Excessive Rotor Spin | Gas in Liquid | Install Gas Eliminator ahead of meter or raise liquid level in vessel to a height sufficient to prevent gas flow. Inspect Rotor Assembly for wear or damage. |

Repair Procedures

Numbers in parentheses (#) are items in parts drawing/lists starting on page 23.

A. Body

1. Remove the sideplates (9) and the rotor assembly (18).
2. Remove bridge screws (28) and washers (29) using 7/32-inch hex key.
3. Remove the bridge (25).
4. Remove the liner wedge (19), by prying out with a screwdriver.
5. Remove the liner (17). The liner should slide out of the body freely.
6. Clean the meter body by removing scale deposits or rust with a wire brush and emery cloth. Apply a thin coat of rust inhibitor to all machined surfaces.
7. Replace the liner. Attach one sideplate assembly with three bolts, but without the O-ring. Insert the liner, positioned with its edges equally spaced from the bridge screws and snug against the sideplate.
8. Insert the wedge (19) between the bridge screws with the wedge apex against the bridge.
9. Insert the bridge with the screws very loose.

10. Tighten the bridge screws evenly until the wedge is slightly flattened. Check the liner clearance to the sideplate with a 0.0015" to 0.002" feeler gage. If the feeler gage slides beneath the liner, tap the liner (with a hardwood or plastic mallet). Tighten the bridge screws until the bridge is snug against the liner.
11. With the liner wedged in place, remove the bridge and sideplate. Dress the edges of the liner until they are smooth and flush with the meter body facings.
12. Replace the bridge, leaving the bridge screws loose. Do not tighten the bridge screws until the sideplate assemblies are attached and snug. The sideplates will align the bridge in the correct position when the bridge screws are tightened.
13. Replace the bridge seals (24) and body seal O-rings (20).
14. Proceed to further assembly as required.

B. Rotor

Inspect all rubber covered parts. Some visible wear is normal and will not affect the accuracy of the meter. If the rubber coating is missing from any part, replace the part.

Inspect for broken springs, broken or missing boots, missing or damaged rotor blade hinge grommets.

Replacement of hinge assemblies:

1. Remove retaining clips (14) from hinge pins (13).
2. Remove hinge pins with pliers allowing hinges, springs and grommets to be removed.
3. To assemble rotor, insert hinge pin in appropriate hole in web so that hinge arm will slip on.
4. Insert spring with grommets in place so that holes are aligned with pin.
5. Insert hinge pin through all grommet holes and through pin hole in opposite web.
6. Hold hinge pin firmly in place and insert retaining clip.

NOTICE

Hinge pin should be firmly in place without wobble or lateral movement.

7. Repeat steps 1 through 6 for each hub section.

C. Sideplate

NOTE: Sideplate bushings are designed with left-hand threads.

1. Remove register and register adapter, magnetic coupling assembly, or blind nut from sideplate.
2. Unscrew bearing nut (6) with a wide blade screwdriver.
3. Slide out bearing assembly.
4. Remove wearplate (30) from the sideplate.
5. Remove O-ring (56).
6. To remove bushing, place sideplate face down on flat surface such as 2 x 8-inch wood block with a 1/2-inch O.D. hole bored in wood.

Continued on next page...

7. Using bushing insertion tool 1434 or similar flat tool, place tool against bushing and tap sharply with a small hammer. The bushing is pressed in place and will fall out easily when the pressure is released.
8. To replace bushing, turn sideplate face up, insert the bushing using tool 1434, and tap with small hammer until bushing is flush with sideplate face. Do not dent or sear bushing or sideplate. Bushing must be flush with sideplate to within 0.003 of an inch.
9. Replace O-ring (5) and wearplate (30).
10. Insert bearing assembly (12) taking care that bearing sleeve lugs fit into lug slots in bushing.
11. Insert and tighten bearing nut (6).

D. Magnetic Coupling

Note: Reference parts drawing and list pages 30-31.

1. Remove driven magnet assembly.
2. Remove flange bearing from housing bearing assembly. *Do not beat end of housing bearing assembly on hard surface to remove bushing.* Instead, use small needle nose pliers with smooth surfaces that will not damage the bearing.
3. Remove drive coupling and shaft assembly with drive magnet as one unit from the housing bearing assembly.
4. Remove all O-rings.
5. Remove retaining ring with flat surface of standard screwdriver or E-018 Truarc applicator and slide drive magnet off end of drive coupling and shaft assembly.
6. Clean parts with petroleum cleaning (Stoddard) solvent.
7. Inspect all parts for excessive/uneven wear. Replace all worn parts.
8. Place a drop of oil on each O-ring and work the oil into the surface.
9. Apply a heavy coat of grease to outside of housing bearing assembly.
10. Install O-ring onto housing bearing assembly.
11. Install drive pin in drive coupling and shaft assembly. Slide drive magnet over drive coupling and shaft assembly. Secure drive magnet with retaining ring by using E-018 Truarc applicator. E-ring fits into groove in the drive coupling and shaft assembly.
12. Slide drive coupling and shaft assembly with drive magnet attached into housing bearing assembly, aligning end of shaft into bearing in the inside of bearing housing assembly.
13. Install O-rings on bushing and then insert bushing (larger inside diameter [approx. 7/16-inch] end first) into bearing housing.
14. Slide driven magnet assembly over housing bearing assembly.
15. Slowly start threading housing bearing assembly onto bushing of register sideplate assembly (left-hand thread) and at the same time rotate driven magnet assembly back and forth until slot of drive coupling and shaft assembly is engaged into rotor shaft. If drive coupling and shaft assembly is not properly engaged onto rotor shaft, housing assembly will not thread properly and will jam.

16. When it is determined that drive coupling and shaft assembly is firmly engaged onto rotor shaft, continue to thread the housing bearing assembly onto register sideplate assembly until it is tight against O-ring. Tighten securely with one-inch open-end wrench. The housing bearing assembly will move approximately 1/4-inch into bushing of sideplate assembly when completely tightened.
17. Push register adapter over driven magnet assembly so the worm is in alignment with worm gear and register adapter is tight against the sideplate. Secure with two 10-32 x 1/2 screws.
18. Re-install calibration gears, register assembly, register gasket and register cover using two screws.

SECTION 5 - M500 MAGNETIC COUPLING OPTION

Introduction

The Floco M500 Magnetic Coupling transmits power from the rotor to a standard small register, small reset register, large numeric reset register/ticket printer, and other accessories. A magnet on the rotor side is magnetically coupled to a magnet on the register side — eliminating pressure seals.

The M500 can be installed on applicable meter already in use, provided the rated torque limit is not exceeded. The register adapter (0000.2931.0) is used with the F500 Series meters.

M500 Installation

If the M500 was ordered separately, turn worm gear by hand and check that the drive coupling (0500.1024.B) and shaft assembly rotates.

Make sure the torque demanded from the worm in the coupling is limited to a maximum of 12 ounce-inches.

Tools Required for Installation and Repair:

- 7/8-inch open-end wrench (to remove LP seal housing)
- 1-inch open-end wrench (to install magnetic coupling)
- Standard Screwdriver (for removal of screws)
- Can of lightweight Oil (Lubrication)
- E-018 Truac Applicator (to remove retaining rings)
- 1/32-inch Pin Punch & Small Ballpeen Hammer (to remove/install worm pin)

Note: Letters in parentheses (X) correspond to items in illustration on page 18.

A. Preliminary Procedure

The following preliminary procedure is necessary to mount the magnetic coupling on the applicable meter if the coupling was ordered as a separate item. If a complete meter was ordered with the magnetic coupling included, omit the mounting instructions in this supplement and mount the entire meter as directed in the installation section of the applicable technical manual.

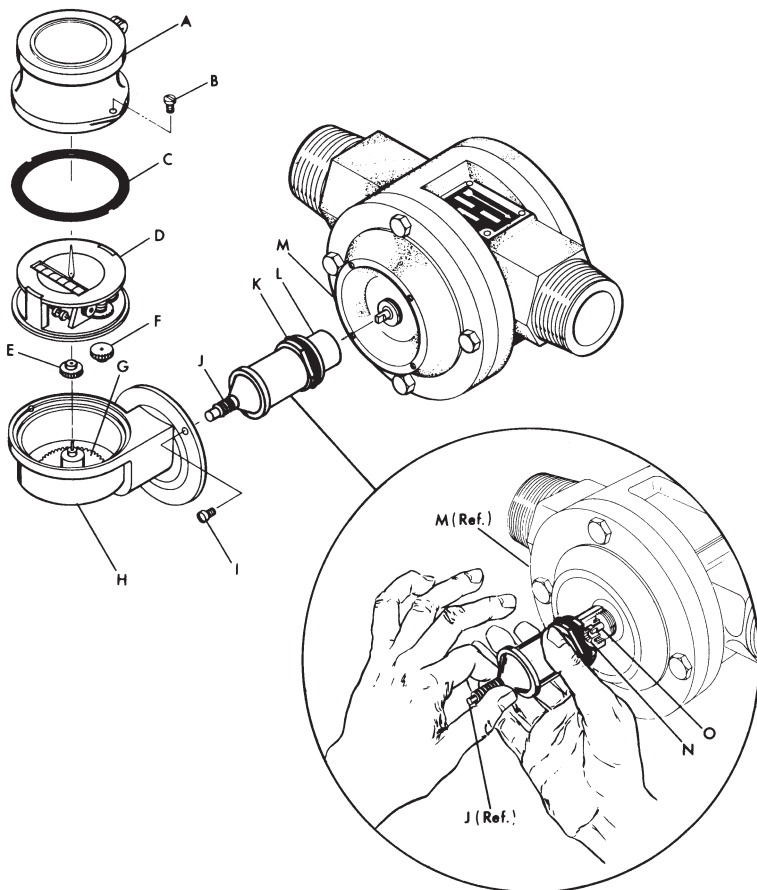
1. Close isolation valves upstream and downstream from the Floco meter.
2. Relieve pressure from Floco meter, using a method suited to the particular installation.

B. Removal of Low Pressure Seal Assembly (Refer to page 18)

1. Remove the two 10-32 x 1/2 screws (B) that secure register box assembly (A) to the register adapter assembly (H), lift off register box assembly, register gasket (C), and register assembly (D), and remove drive calibration gear (E) from register adapter assembly.
2. Remove the two 10-32 x 1/2 screws (I) that secure register adapter assembly (H) over low pressure seal.
3. Using a 7/8-inch open-end wrench, remove low pressure seal housing (left-hand thread) from register sideplate assembly (M).

C. Mounting the Model 500 Magnetic Coupling

1. Remove coupling housing (L) from register adapter (H).



| Item | Description | Item | Description |
|------|--|------|---|
| A | Register Box Assembly | I | Screw, 10-32 x ½-inch 10-32 x ¼-inch |
| B | Screw, 10-32 x ½-inch | J | Worm |
| C | Register Gasket | K | O-Ring |
| D | Register Assembly | L | Housing Bearing Assembly |
| E | Drive Calibration Gear | M | Register Sideplate Assembly |
| F | Driven Calibration Gear | N | Drive Coupling & Shaft Assembly |
| G | Worm Gear & Shaft Assembly | O | Rotor Shaft |
| H | Register Adaptor Housing 0000.2931.0 fits F-500 & F-2500 0000.2932.0 fits F-5000 | | |

2. Slowly start threading coupling housing Q onto bushing of register sideplate assembly (M) (left-hand thread) and at the same time rotate worm (J) back and forth until slot of drive coupling and shaft assembly (N) is engaged onto rotor shaft (O). If drive coupling and shaft assembly is not properly engaged onto rotor shaft, housing assembly will not thread properly and will jam.

C. Mounting the Model 500 Magnetic Coupling (Continued)

3. When it is determined that drive coupling and shaft assembly (N) is firmly engaged onto rotor shaft (O), continue to thread coupling housing (L) onto register sideplate assembly (M) until coupling housing is tight against O-ring. Tighten securely with 1-inch open-end wrench. Coupling housing (L) will move approximately $\frac{1}{4}$ inch onto bushing or sideplate assembly to be completely tightened.
4. Push register adapter (H) over coupling housing (L) so that magnetic drive assembly and worm (J) is in alignment with worm gear (G) and tight against flange of sideplate assembly (M), and secure with two 10-32 x $1\frac{1}{2}$ screws. If necessary, install worm gear assembly (G) in register adapter.
5. Install drive calibration gear (E) which was previously removed onto end of split shaft of worm gear assembly (G), with small hub of gear facing up.
6. Place register assembly (D) over register adapter assembly (H), set register gasket (C) in flange of register assembly, place register box assembly (A) over register assembly, and secure with the two 10-32 x $1\frac{1}{2}$ screws.

M500 Troubleshooting And Repair

Servicing

The servicing information in this section refers only to the Model 500 Magnetic Coupling, which has replaced the low-pressure seal. To service those portions of the meter that were not changed by the installation of the magnetic coupling, refer to the applicable sections or pages as directed.

Troubleshooting Suggestions

If regularly maintained, Floco meters will provide long trouble-free service. If trouble becomes evident, the source of trouble will usually be found in the magnetic coupling, rotor assembly, or bearings.

Maintenance

A. Register Removal (refer to page 18)

Regular inspection and preventive maintenance on the magnetic couplings of Floco meters, in addition to the prescribed maintenance of the other major parts of the meter, will ensure many months of trouble-free service. It is suggested that the following maintenance program be performed semiannually. However, this program should be adapted to the type of liquid metered, based on corrosive and abrasive qualities. Only the maintenance of the magnetic coupling is described in detail in this supplement; refer to the maintenance section in the main portion of the manual as directed for maintenance of other parts of the meter.

Remove Register as follows:

1. Close isolation valves upstream and downstream from Floco meter.
2. Relieve pressure on meter.

3. Remove screws (B) that secure register box assembly (A) to register adapter (H), and remove register box assembly, register gasket (C), and register assembly (D).
4. Remove screws (I) that secure register adapter (H) to register sideplate assembly (M) of body assembly, and slide register adapter off coupling housing.
5. Use a 1-inch open-end wrench to loosen coupling housing (L) from bushing of register sideplate assembly (M) (left-hand thread) and then continue to unscrew and finally separate coupling housing from sideplate assembly.

B. Magnetic Coupling Maintenance

Refer to the following troubleshooting table for suggestions and inspection procedures.

Troubleshooting Table:

| Part No. & Name | Inspection | Probable Cause |
|--|---|--|
| 0087.1014.T Retaining Ring | If ring is distorted or corroded it should be replaced. | |
| Worm, Worm Gear & Shafts | If tops of teeth are thin or sharp, especially in center area, replace. On shafts, any visible wear that can be felt with the fingernail is cause for replacement of corresponding assembly (worm or worm gear and associated shaft). | Water getting into worm & worm gear area or misalignment between worm & worm gear. Wrong worm & worm gear ratio. |
| | Note: Always replace O-rings (if any) associated with worn parts that are replaced. Be sure new O-rings are of the same material as used in original O-ring. | |
| 0000.2944.0 O-Ring Bushing | Check if bore is out of round. If it is, replace bushing. Inspect O-rings associated with 0000.2944.0 bushings; if worn, replace. | Badly worn rotor bearings or rotor shaft. Worn drive coupling & shaft assembly. 0500.1024.B |
| 0500.1024.B Drive Coupling & Shaft Assy. | If wear is uneven or excessive, replace. | Wear of rotor bearings, or other parts. Evidence of even wear would be normal if the coupling had been in service for a long time. |
| 0500.1025.B Magnet Drive Assembly | Check for uneven or excessive wear. If wear is uneven, inspect magnet for grooves or gouges, and replace, if necessary. | Worn housing bearing assembly. 0500.1026.B |

NOTE: The following procedure assumes that register and magnetic coupling have already been removed from meter and that coupling housing has been removed from register adapter as previously described.

1. Disassembly of Magnetic Coupling (refer to pages 30-31):
 - a. Remove magnet drive assembly with worm.
 - b. Drive out roll pin from worm if necessary to replace with new worm.
 - c. Remove bushing from housing bearing assembly. Do not beat end of housing bearing assembly on hard surfaces to remove bushing. Remove with small needle nose pliers that have smooth surfaces so as not to damage bushing.

- d. Remove drive coupling and shaft assembly with drive magnet as one unit from the housing bearing assembly.
 - e. Remove all O-rings.
 - f. Remove retaining ring with flat surface of standard screwdriver or E-018 Truac applicator and slide drive magnet off end of drive coupling and shaft assembly.
 - g. Clean parts with petroleum cleaning (Stoddard) solvent.
2. Inspection of Magnetic Coupling Parts
- a. Inspect all parts closely for signs of excessive or uneven wear.
 - b. Check that drive magnet slot is aligned against drive pin of shaft. If necessary, push magnet tight against pin and reset retaining ring with E-018 Truac applicator.
 - c. Replace all worn parts.

NOTE: Make sure new O-rings are of the same material as the original O-rings or of a material compatible with fluid conditions.

3. Reassembly of Magnetic Coupling:

NOTE: Before reassembling magnetic coupling place one drop of oil on each O-ring used in reassembly and work oil onto all surfaces of O-ring. Lubricate bearing surfaces with oil or good grease lubricant.

- a. Install O-ring onto housing bearing assembly.
- b. Install drive pin in drive coupling and shaft assembly. Slide drive magnet over drive coupling and shaft assembly. Secure drive magnet with retaining ring by using E-018 Truac applicator. Retaining ring fits into groove in the drive coupling and shaft assembly.
- c. Slide drive coupling and shaft assembly with drive magnet attached into housing bearing assembly, aligning end of shaft into bearing in the inside of bearing housing assembly.
- d. Install O-rings on bushing and then insert bushing into bearing housing assembly, with end having larger inside diameter (about 7/16") being inserted first.
- e. Install worm over shaft on drive magnet assembly and align holes for worm pin. Drive roll pin through holes in worm and shaft, being careful not to bend or distort shaft or assembly.
- f. Slide magnet drive assembly over housing bearing assembly).
- g. **Refer to page 18.** Assuming register sideplate assembly (M) has been reinstalled on body, slowly start threading coupling housing (L) onto bushing of sideplate assembly (left-hand thread) and at the same time rotate worm (J) back and forth until slot of drive coupling and shaft assembly (N) is engaged onto rotor shaft (O). If drive coupling/shaft assembly is not properly engaged onto rotor shaft, housing assembly will not thread properly and will jam.

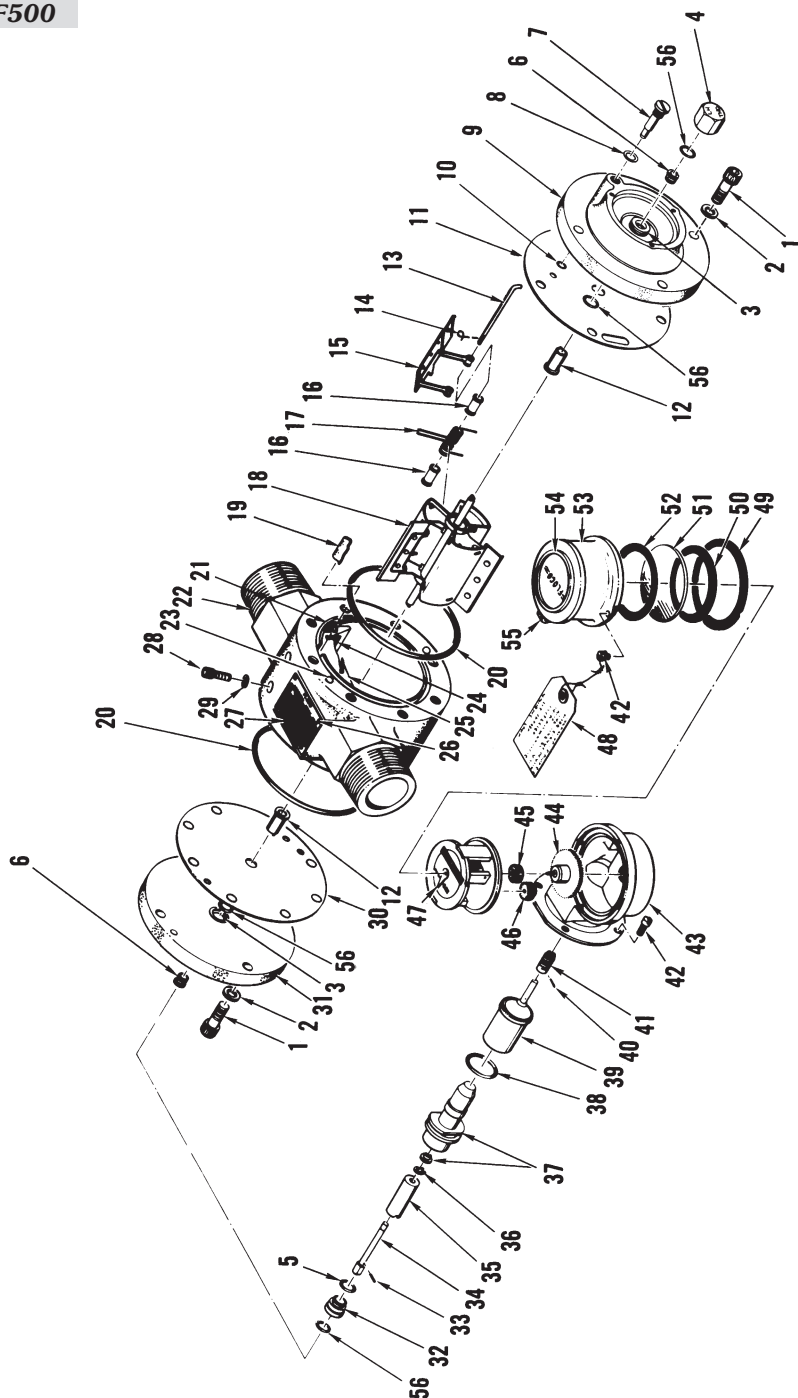
B. Magnetic Coupling Maintenance (continued)

- h. When it is determined that drive coupling and shaft assembly is firmly engaged onto rotor shaft (O), continue to thread coupling housing (L) onto register sideplate assembly (M) until it is tight against O-ring.
Tighten securely with 1-inch open-end wrench. Coupling housing will move approximately 1/4-inch onto bushing of sideplate assembly to be completely tightened.
- i. Push register adapter (H) over coupling housing (L) so that magnetic drive assembly and worm (J) is in alignment with worm gear (G) and tight against flange of register sideplate assembly (M), and secure with the two screws (I).
- j. Pour enough lightweight lubricating oil into register adapter (H) to cover approximately half the thickness of toothed section of worm gear (G).
- k. Place register assembly (D) over register adapter (H), set register gasket (C) in flange of register assembly, place register box assembly (A) over register assembly, and secure with the two 10-32 x 1/2 screws (B).

NOTE: Drive and driven magnets are of sintered material (very hard) and could be broken if struck a direct hard blow with a hammer.

SECTION 6 - PARTS LIST/DRAWING

F500



SECTION 6 - PARTS LIST/DRAWING (Continued)

F500 Parts List

| Item | Description | Part No. | Per Unit |
|------|-----------------------------------|-------------|----------|
| 1 | Body Bolt: | | 8 |
| | (a) 1" & 2" Meters | 0220.1053.J | |
| | (b) 3" Meters | 0000.0308.0 | |
| 2 | Washer, 3/8" Flat | 0000.1985.0 | 16 |
| 3 | Bushing, Sideplate | 2500.2112.C | 2 |
| 4 | Nut, Blind | 0000.0915.0 | 2 |
| 5 | O-Ring | | 1 |
| | (a) Buna-N | 0001.0105.R | |
| | (b) Viton | 0001.0037.R | |
| | (c) Teflon | 0001.0116.R | |
| 6 | Nut, Bearing | 0000.1254.0 | 2 |
| 7 | Alignment Plug | 0000.2508.0 | 1 |
| 8 | Gasket | 0000.1116.0 | 1 |
| 9 | Sideplate Assembly, Sampler Side: | | 1 |
| | (a) Steel (1" & 2" Meters) | 0500.1244.B | |
| | (b) Steel (3" Meters) | 0000.2498.0 | |
| | (c) 316 SST | 0000.2305.0 | |
| 10 | Retaining Ring | 0087.1014.T | 2 |
| 11 | Wearplate, Sampler Side: | | 1 |
| | (a) Chrome Plated | 0000.2276.0 | |
| | (b) No Chrome | 0022.7627.0 | |
| 12 | Rotor Bearing: | | 2 |
| | (a) Aluminum Bronze | 0000.2529.0 | |
| | (b) Carbon Graphite | 0000.2496.0 | |
| | (c) Meehanite | 0000.2528.0 | |
| | (d) Glass-Filled Teflon | 0000.2947.0 | |
| 13 | Rotor Hinge Pin: | | 3 |
| | (a) 1" & 2" Meters | 0500.2030.C | |
| | (b) 3" Meters | 0500.2031.C | |
| 14 | Clip, Retaining | 0500.2032.C | 2 |
| 15 | Rotor Hinge Assembly: | | 3 |
| | (a) Buna-N (1" & 2" Meters) | 0000.0361.0 | |
| | (b) Buna-N (3" Meters) | 0000.0252.0 | |
| | (c) Viton (1" & 2" Meters) | 0000.2334.0 | |
| | (d) Viton (3" Meters) | 0000.2569.0 | |
| | (e) Teflon (1" & 2" Meters) | 0000.3146.0 | |
| | (f) Teflon (3" Meters) | 0000.3151.0 | |
| 16 | Rotor Hinge Spring Grommet: | | 6* |
| | (a) Buna-N | 0000.3046.0 | |
| | (b) Viton | 0000.3047.0 | |
| | (c) Teflon | 0000.2958.0 | |
| 17 | Rotor Hinge Spring: | | 3* |
| | (a) Inconel | 0000.0362.0 | |
| | (b) Epoxy-Coated Inconel | 0003.6229.0 | |
| | (c) 316 SST | 0000.2904.0 | |

F500 Parts List Continued

| Item | Description | Part No. | Per Unit |
|------|--|-------------|----------|
| 18 | Rotor Assembly: | | 1 |
| | (a) Riveted with Buna-N (1" & 2" Meters) | 0000.1532.0 | |
| | (b) SST, Welded with Buna-N (1" & 2" Meters) | 0000.3197.0 | |
| | (c) Riveted with Buna-N (3" Meters) | 0000.1534.0 | |
| | (d) SST, Welded with Buna-N (3" Meters) | 0000.3201.0 | |
| | (e) Riveted with Viton (1" & 2" Meters) | 0000.2326.0 | |
| | (f) SST, Welded with Viton (1" & 2" Meters) | 0000.3196.0 | |
| | (g) Riveted with Viton (3" Meters) | 0000.2561.0 | |
| | (h) SST, Welded with Viton (3" Meters) | 0000.3200.0 | |
| | (i) SST, Welded with Teflon (1" & 2" Meters) | 0000.2962.0 | |
| | (j) SST, Welded with Teflon (3" Meters) | 0000.2976.0 | |
| | (k) Delrin (1" & 2" Meters) Buna-N | 0000.1533.0 | |
| 19 | Wedge | 0000.0302.0 | 6* |
| 20 | O-Ring: | | 2 |
| | (a) (304) Buna-N | 0001.0167.R | |
| | (b) Viton | 0001.0171.R | |
| 21 | Liner, 316 SST: | | 1 |
| | (a) 1" & 2" Meters | 0000.0301.0 | |
| | (b) 3" Meters | 0000.2656.0 | |
| 22 | Meter Body: | | 1 |
| | (a) Steel, 1" Meters | 0000.0263.0 | |
| | (b) Steel, 2" Meters | 0000.0264.0 | |
| | (c) Steel, 3" Meters | 0000.2848.0 | |
| | (d) 316 SST, 1" Meters | 0000.2906.0 | |
| | (e) 316 SST, 2" Meters | 0000.2281.0 | |
| | (f) 316 SST, 3" Meters | 0000.2850.0 | |
| 23 | Dowel Pin | 0000.0303.0 | 4 |
| 24 | Bridge Seals (2 per Set): | | 1* |
| | (a) Buna-N | 0000.2791.0 | |
| | (b) Viton | 0000.0347.0 | |
| | (c) Teflon | 0000.2974.0 | |
| 25 | Bridge: | | 1 |
| | (a) Delrin (1" & 2" Meters) | 0000.2370.0 | |
| | (b) Delrin (3" Meters) (2 per set) | 0000.2762.0 | |
| | (c) Steel (1" & 2" Meters) | 0000.0342.0 | |
| | (d) Steel (3" Meters) (2 per set) | 0000.2816.0 | |
| | (e) 316 SST (1" & 2" Meters) | 0000.2290.0 | |
| | (f) 316 SST, (3" Meters) (2 per set) | 0000.2817.0 | |
| 26 | Drive Screw | 0000.0370.0 | 2 |
| 27 | Nameplate | 0000.2287.0 | 1 |
| 28 | Screw | 0500.1347.C | 2* |
| 29 | Washer | 0000.2300.0 | 2* |
| 30 | Wearplate, Register Side: | | 1 |
| | (a) Chrome Plated | 0000.2275.0 | |
| | (b) No Chrome | 0022.7527.0 | |

SECTION 6 - PARTS LIST/DRAWING (Continued)

F500 Parts List Continued

| Item | Description | Part No. | Per Unit |
|------|--|-------------|----------|
| 31 | Sideplate Assembly, Register Side: | | 1 |
| | (a) Steel (1" & 2" Meters) | 0500.1242.B | |
| | (b) Steel (3" Meters) | 0000.2497.0 | |
| | (c) 316 SST | 0000.2304.0 | |
| 32 | Bushing | 0000.2944.0 | 2 |
| 33 | Magnet-Drive Drive Pin | 0000.1699.0 | 1 |
| 34 | Magnet-Drive Drive Coupling & Shaft Assembly | 0500.1024.B | 1 |
| 35 | Magnet, Drive | 0382.1057.C | 1 |
| 36 | Retaining Ring | 0087.1014.T | 1 |
| 37 | Housing Bearing Assembly | 0500.1026.B | 1 |
| 38 | O-Ring, Buna-N | 0001.0104.R | 1 |
| 39 | Magnet Drive Assembly | 0500.1025.B | 1 |
| 40 | Pin, Worm | 0000.0324.0 | 1 |
| 41 | Worm: | | 1 |
| | (a) 12.5:1 Ratio, Steel | 0000.3192.0 | |
| | (b) 20:1 Ratio, Steel | 0000.0255.0 | |
| | (c) 40:1 Ratio, Steel | 0000.0254.0 | |
| | (d) 40:1 Ratio, Zytel | 0002.5435.0 | |
| 42 | Screw | 0000.1612.0 | 4 |
| 43 | Register Adapter Assembly | 0000.2931.0 | 1 |
| 44 | Worm Gear Assembly: | | 1 |
| | (a) 20:1 Ratio | 0000.0257.0 | |
| | (b) 40:1 Ratio (Delrin Gear) | 0002.5637.0 | |
| | (c) 12.5:1 Ratio | 0000.3191.0 | |
| | (d) 40:1 Ratio | 0000.0256.0 | |
| 45 | Calibration Driven Gear (Specify Diameter & # of Teeth): | | 1 |
| | Dia. .375, Teeth 15 | 0020.1011.C | |
| | Dia. .375, Teeth 16 | 0020.1012.C | |
| | Dia. .375, Teeth 17 | 0020.1013.C | |
| | Dia. .375, Teeth 18 | 0020.1014.C | |
| | Dia. .375, Teeth 19 | 0020.1015.C | |
| | Dia. .460, Teeth 18 | 0020.1016.C | |
| | Dia. .460, Teeth 19 | 0020.1017.C | |
| | Dia. .460, Teeth 20 | 0020.1018.C | |
| | Dia. .460, Teeth 21 | 0020.1019.C | |
| | Dia. .460, Teeth 22 | 0020.1020.C | |
| | Dia. .460, Teeth 23 | 0020.1021.C | |
| | Dia. .460, Teeth 24 | 0020.1022.C | |
| | Dia. .570, Teeth 21 | 0020.1023.C | |
| | Dia. .570, Teeth 22 | 0020.1024.C | |
| | Dia. .570, Teeth 23 | 0020.1025.C | |
| | Dia. .570, Teeth 24 | 0020.1026.C | |
| | Dia. .570, Teeth 25 | 0020.1027.C | |
| | Dia. .570, Teeth 26 | 0020.1028.C | |
| | Dia. .570, Teeth 27 | 0020.1029.C | |

F500 Parts List Continued

| Item | Description | Part No. | Per Unit |
|------|---|-------------|----------|
| 45 | Calibration Driven Gear (Specify Diameter & # of Teeth) (Cont): | | 1 |
| | Dia. .570, Teeth 28 | 0020.1030.C | |
| | Dia. .670, Teeth 21 | 0020.1031.C | |
| | Dia. .670, Teeth 22 | 0020.1032.C | |
| | Dia. .670, Teeth 23 | 0020.1033.C | |
| | Dia. .670, Teeth 24 | 0020.1034.C | |
| | Dia. .670, Teeth 25 | 0020.1035.C | |
| | Dia. .670, Teeth 26 | 0020.1036.C | |
| | Dia. .670, Teeth 27 | 0020.1037.C | |
| | Dia. .670, Teeth 28 | 0020.1038.C | |
| | Dia. .670, Teeth 29 | 0020.1039.C | |
| | Dia. .670, Teeth 30 | 0020.1040.C | |
| | Dia. .670, Teeth 31 | 0020.1041.C | |
| | Dia. .670, Teeth 32 | 0020.1042.C | |
| | Dia. .670, Teeth 33 | 0020.1043.C | |
| | Dia. .670, Teeth 34 | 0020.1044.C | |
| | Dia. .670, Teeth 35 | 0020.1045.C | |
| | Dia. .670, Teeth 36 | 0020.1046.C | |
| | Dia. .670, Teeth 37 | 0020.1047.C | |
| | Dia. .670, Teeth 19 | 0020.1097.C | |
| | Dia. .670, Teeth 20 | 0020.1098.C | |
| | Dia. .670, Teeth 38 | 0020.1099.C | |
| | Dia. .670, Teeth 40 | 0020.1100.C | |
| | Dia. .670, Teeth 41 | 0020.1101.C | |
| | Dia. .770, Teeth 26 | 0020.1048.C | |
| | Dia. .770, Teeth 27 | 0020.1049.C | |
| | Dia. .770, Teeth 28 | 0020.1050.C | |
| | Dia. .770, Teeth 29 | 0020.1051.C | |
| | Dia. .770, Teeth 30 | 0020.1052.C | |
| | Dia. .770, Teeth 31 | 0020.1053.C | |
| | Dia. .770, Teeth 32 | 0020.1054.C | |
| | Dia. .770, Teeth 33 | 0020.1055.C | |
| | Dia. .770, Teeth 34 | 0020.1056.C | |
| | Dia. .770, Teeth 35 | 0020.1057.C | |
| | Dia. .770, Teeth 36 | 0020.1058.C | |
| | Dia. .770, Teeth 37 | 0020.1059.C | |
| | Dia. .770, Teeth 38 | 0020.1060.C | |
| | Dia. .770, Teeth 39 | 0020.1061.C | |
| | Dia. .860, Teeth 32 | 0020.1062.C | |
| | Dia. .860, Teeth 33 | 0020.1063.C | |
| | Dia. .860, Teeth 34 | 0020.1064.C | |
| | Dia. .860, Teeth 35 | 0020.1065.C | |
| | Dia. .860, Teeth 36 | 0020.1066.C | |
| | Dia. .860, Teeth 37 | 0020.1067.C | |
| | Dia. .860, Teeth 38 | 0020.1068.C | |

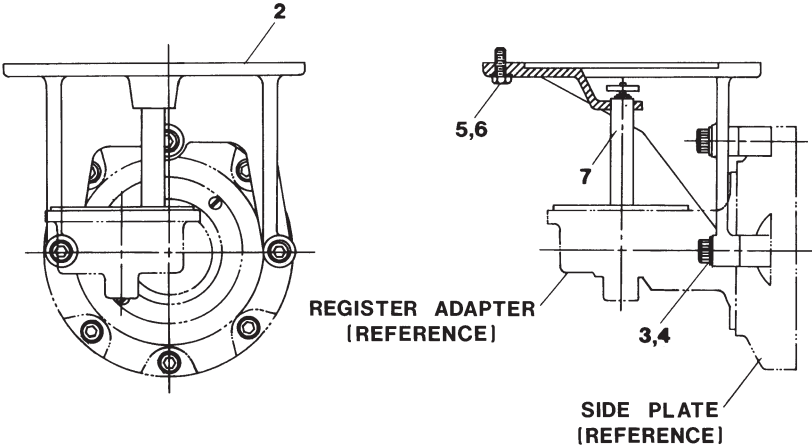
SECTION 6 - PARTS LIST/DRAWING (Continued)

F500 Parts List Continued

| Item | Description | Part No. | Per Unit |
|------|---|-------------|----------|
| 45 | Calibration Driven Gear (Specify Diameter & # of Teeth) (Cont): | | 1 |
| | Dia. .860, Teeth 39 | 0020.1069.C | |
| | Dia. .860, Teeth 40 | 0020.1070.C | |
| | Dia. .860, Teeth 41 | 0020.1071.C | |
| | Dia. .860, Teeth 42 | 0020.1072.C | |
| | Dia. .860, Teeth 43 | 0020.1073.C | |
| | Dia. .860, Teeth 44 | 0020.1074.C | |
| | Dia. .968, Teeth 41 | 0020.1075.C | |
| | Dia. .968, Teeth 42 | 0020.1076.C | |
| | Dia. .968, Teeth 43 | 0020.1077.C | |
| | Dia. .968, Teeth 44 | 0020.1078.C | |
| | Dia. .968, Teeth 45 | 0020.1079.C | |
| | Dia. .968, Teeth 46 | 0020.1080.C | |
| | Dia. .968, Teeth 47 | 0020.1081.C | |
| | Dia. .968, Teeth 48 | 0020.1082.C | |
| | Dia. .968, Teeth 49 | 0020.1083.C | |
| | Dia. .968, Teeth 50 | 0020.1084.C | |
| | Dia. .968, Teeth 51 | 0020.1085.C | |
| 46 | Calibration Driven Gear (Same as Item #45) | | 1 |
| 47 | Register Assembly: | | 1 |
| | (a) U.S. Gallons (1", 2" & 3" Meters) | 0000.3015.0 | |
| | (b) 42 Gallon Barrels | 0000.3059.0 | |
| | (c) U.S. Gallons (3" Meters) (10 Gal. Readout) | 0000.3126.0 | |
| | (d) Imperial Gallons (1" & 2" Meters) | 0000.3127.0 | |
| | (e) Liters | 0000.3129.0 | |
| | (f) Cubic Meters | 0000.3132.0 | |
| | Reset Register Assembly (Less Box) (Not Shown): | | 1 |
| | (a) 42 Gallon Barrels | 0000.2386.0 | |
| | (b) U.S. Gallons (1" & 2" Meters) | 0000.2574.0 | |
| | (c) U.S. Gallons (3" Meters) | 0000.2576.0 | |
| | (d) Liters | 0000.2582.0 | |
| | (e) Cubic Meters | 0000.2584.0 | |
| 48 | Not Required | | |
| 49 | Register Gasket | 0000.0253.0 | 1 |
| 50 | Retaining Ring | 0000.1216.0 | 1 |
| 51 | Register Glass | 0000.0337.0 | 1 |
| 52 | Gasket | 0000.1214.0 | 1 |
| 53 | Register Box Assembly | 0000.0332.0 | 1 |
| 54 | Register Lid | 0000.0293.0 | 1 |
| 55 | Register Lid Pin | 0000.0292.0 | 1 |
| 56 | O-Ring: | | 4 |
| | (a) Buna-N | 0001.0146.R | |
| | (b) Viton | 0001.0087.R | |
| | (c) Teflon | 0001.0127.R | |

* (Twice this quantity for 3" Meters)

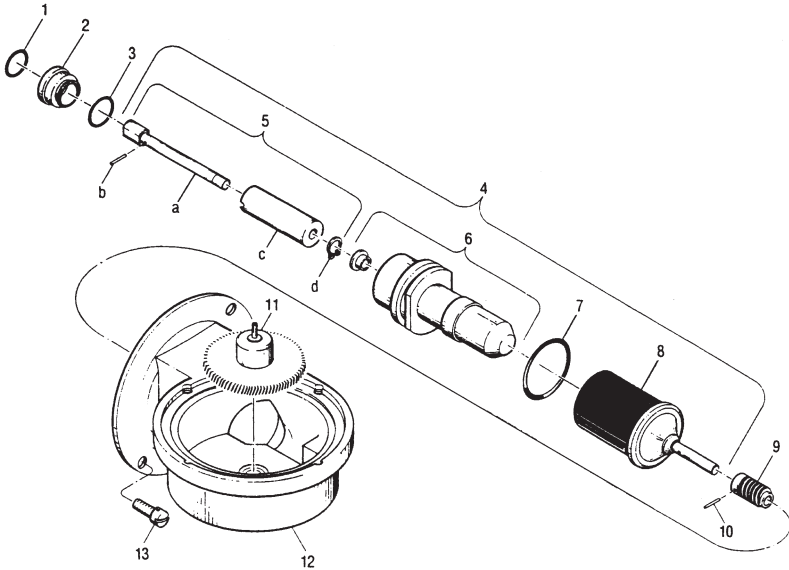
Large Numeral Register Mounting Assembly Parts List



| Item | Description | Part No. | Per Unit |
|------|-----------------------------------|-------------|----------|
| 1 | Item Number Not Used | - | - |
| 2 | Bracket & Bushing Assembly | 0500.1063.B | 1 |
| 3 | Washer | 0000.1679.J | 3 |
| 4 | Bolt, Hex, 5/16-18 x 2-1/2 | 0210.1008.J | 3 |
| 5 | Washer | 0000.2157.0 | 4 |
| 6 | Screw, Cap, Hex Hd. | 0000.1680.0 | 4 |
| 7 | Drive Shaft and Attachment Parts | 0000.1940.0 | 1 |
| 8 | Complete Assembly Kit (Not Shown) | 0000.1718.0 | 1 |

SECTION 6 - PARTS LIST/DRAWING (Continued)

M500 Parts Drawing/Parts List



| Item | Description | Part No. | Per Unit |
|------|---|---|-----------------------|
| *1 | O-Ring: Buna-N Viton Teflon | 0001.0146.R 0001.0087.R 0001.0116.R | 1 |
| 2 | Bushing | 0000.2944.0 | 1 |
| *3 | O-Ring: Buna-N Viton Teflon | 0001.0105.R 0001.0037.R 0001.0127.R | 1 |
| 4 | Magnetic Coupling Assembly | 0500.1028.B | 1 |
| *5 | Magnet-Drive Assy. (Includes the following): (a) Drive Coupling and Shaft Assembly (b) Drive Pin (c) Magnet, Drive (d) Retaining Ring "E" | 0500.1027.B 0500.1024.B 0000.1699.0 0382.1057.C 0087.1014.T | 1 1 1 1 1 |
| 6 | Housing Bearing Assembly | 0500.1026.B | 1 |
| *7 | O-Ring, Buna-N | 0001.0104.R | 1 |
| *8 | Magnet Driven Assembly | 0500.1025.B | 1 |
| 9 | Worm: 12½:1 Ratio, Steel 20:1 Ratio, Steel 40:1 Ratio, Steel 40:1 Ratio, Zytel | 0000.3192.0 0000.0255.0 0000.0254.0 0002.5435.0 | 1 |

M500 Parts Drawing/Parts List (continued)

| Item | Description | Part No. | Per Unit |
|------|---|-------------|----------|
| 10 | Pin, Worm | 0000.0324.0 | 1 |
| 11 | Worm Gear Assembly: | | 1 |
| | 12½:1 Ratio, Brass | 0000.3193.0 | |
| | 20:1 Ratio, Brass | 0000.0257.0 | |
| | 40:1 Ratio, Brass | 0000.0256.0 | |
| | 40:1 Ratio, Delrin | 0002.5637.0 | |
| 12 | Register Adapter Assembly: | | 1 |
| | F500 and F2500 Series Meters | 0000.2931.0 | |
| | F5000 Series Meters | 0000.2932.0 | |
| 13 | Screw | 0000.1612.0 | 4 |
| 14 | Magnetic Coupling Assy. (Items 1 thru 10): | | 1 |
| | 12½:1 Ratio, Steel, with Buna-N | 0500.1030.B | |
| | 20:1 Ratio, Steel, with Buna-N | 0500.1031.B | |
| | 40:1 Ratio, Steel, with Buna-N | 0500.1032.B | |
| | 40:1 Ratio, Zytel, with Buna-N | 0500.1033.B | |
| | 12½:1 Ratio, Steel, with Viton | 0500.1034.B | |
| | 20:1 Ratio, Steel, with Viton | 0500.1035.B | |
| | 40:1 Ratio, Steel, with Viton | 0500.1036.B | |
| | 40:1 Ratio, Zytel, with Viton | 0500.1037.B | |
| | 12½:1 Ratio, Steel, with Teflon | 0500.1038.B | |
| | 20:1 Ratio, Steel, with Teflon | 0500.1039.B | |
| | 40:1 Ratio, Steel, with Teflon | 0500.1040.B | |
| | 40:1 Ratio, Zytel, with Teflon | 0500.1041.B | |
| 15 | Register Adapter Assy. for F500 & F2500 Series (Items 1 thru 13): | | 1 |
| | 12½:1 Ratio, Steel w/Brass Gear, w/Buna-N | 0500.0006.A | |
| | 20:1 Ratio, Steel w/Brass Gear, w/Buna-N | 0500.0007.A | |
| | 40:1 Ratio, Steel, with Buna-N | 0500.0008.A | |
| | 40:1 Ratio, Zytel, with Buna-N | 0500.0009.A | |
| | 12½:1 Ratio, Steel, with Viton | 0500.0010.A | |
| | 20:1 Ratio, Steel, with Viton | 0500.0011.A | |
| | 40:1 Ratio, Steel, with Viton | 0500.0012.A | |
| | 40:1 Ratio, Zytel, with Viton | 0500.0013.A | |
| | 12½:1 Ratio, Steel, with Teflon | 0500.0014.A | |
| | 20:1 Ratio, Steel, with Teflon | 0500.0015.A | |
| | 40:1 Ratio, Steel, with Teflon | 0500.0016.A | |
| | 40:1 Ratio, Zytel, with Teflon | 0500.0017.A | |
| 16 | Register Adapter Assy. for F5000 Series (Items 1 thru 13): | | 1 |
| | 20:1 Ratio, Steel, with Buna-N | 0500.0019.A | |
| | 40:1 Ratio, Steel, with Buna-N | 0500.0020.A | |
| | 40:1 Ratio, Zytel, with Buna-N | 0500.0021.A | |
| | 20:1 Ratio, Steel, with Viton | 0500.0023.A | |
| | 40:1 Ratio, Steel, with Viton | 0500.0024.A | |
| | 40:1 Ratio, Zytel, with Viton | 0500.0025.A | |
| | 20:1 Ratio, Steel, with Teflon | 0500.0027.A | |
| | 40:1 Ratio, Steel, with Teflon | 0500.0028.A | |
| | 40:1 Ratio, Zytel, with Teflon | 0500.0029.A | |

Notes:

* Indicates recommended spare parts.

When ordering parts, specify meter model and serial number.

Item 5: Part 0500.1027.B Magnet Drive Assembly, purchase as one assembly.

Product Warranty

A. Warranty

Cameron International Corporation ("Cameron") warrants that at the time of shipment, the products manufactured by Cameron and sold hereunder will be free from defects in material and workmanship, and will conform to the specifications furnished by or approved by Cameron.

B. Warranty Adjustment

- (1) If any defect within this warranty appears, Buyer shall notify Cameron immediately.
- (2) Cameron agrees to repair or furnish a replacement for, but not install, any product which within one (1) year from the date of shipment by Cameron shall, upon test and examination by Cameron, prove defective within the above warranty.
- (3) No product will be accepted for return or replacement without the written authorization of Cameron. Upon such authorization, and in accordance with instructions by Cameron, the product will be returned shipping charges prepaid by Buyer. Replacements made under this warranty will be shipped prepaid.

C. Exclusions from Warranty

- (1) THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER EXPRESSED OR IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE.
- (2) Components manufactured by any supplier other than Cameron shall bear only the warranty made by the manufacturer of that product, and Cameron assumes no responsibility for the performance or reliability of the unit as a whole.
- (3) "In no event shall Cameron be liable for indirect, incidental, or consequential damages nor shall the liability of Cameron arising in connection with any products sold hereunder (whether such liability arises from a claim based on contract, warranty, tort, or otherwise) exceed the actual amount paid by Buyer to Cameron for the products delivered hereunder."
- (4) The warranty does not extend to any product manufactured by Cameron which has been subjected to misuse, neglect, accident, improper installation or to use in violation of instructions furnished by Cameron.
- (5) The warranty does not extend to or apply to any unit which has been repaired or altered at any place other than at Cameron's factory or service locations by persons not expressly approved by Cameron.

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